Advanced Manufacturing: An Extraordinary Technology Ecosystem

National Aeronautics and Space Administration

NASA

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Space Technology Mission Directorate

Made for Space Workshop
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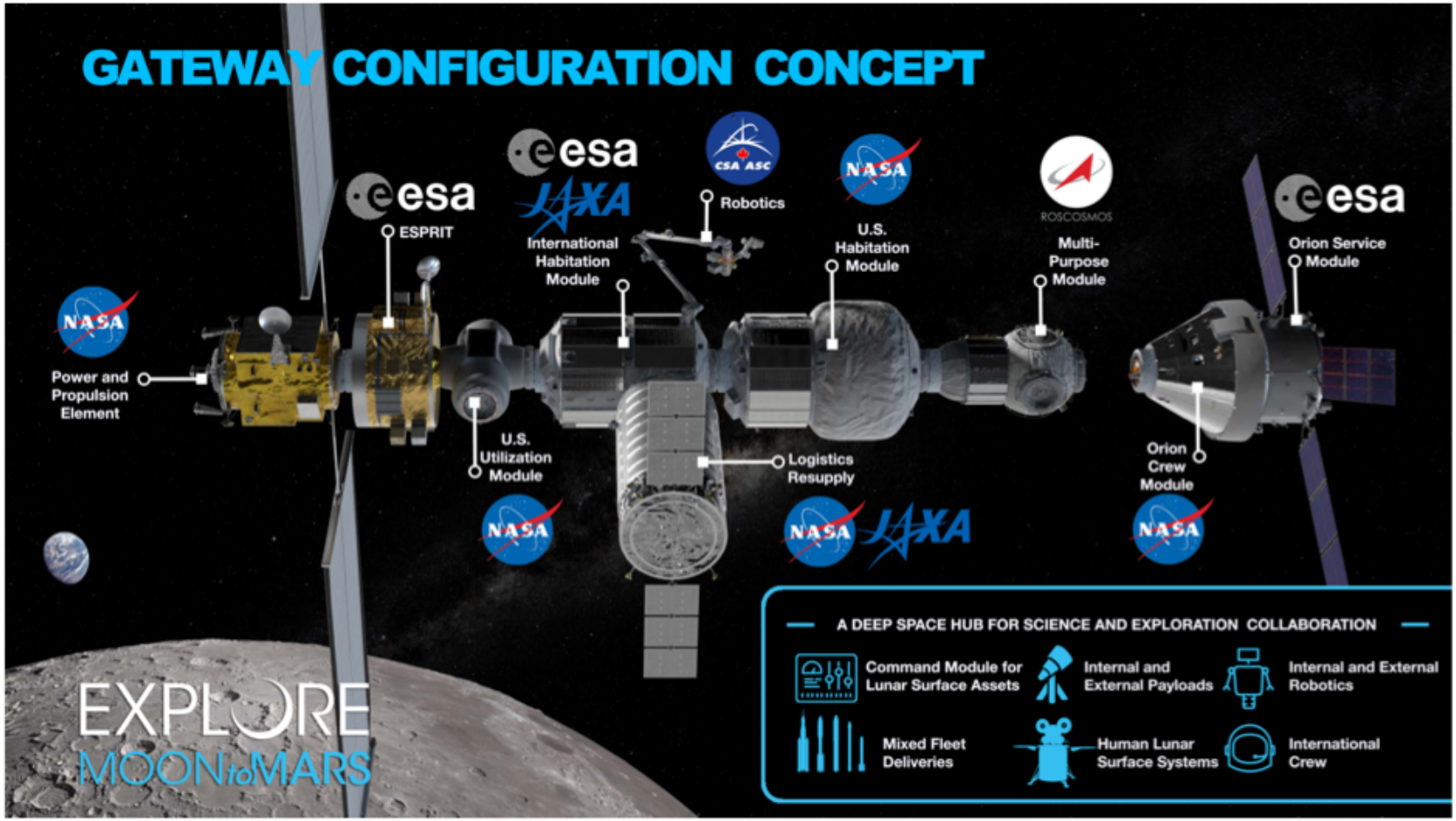
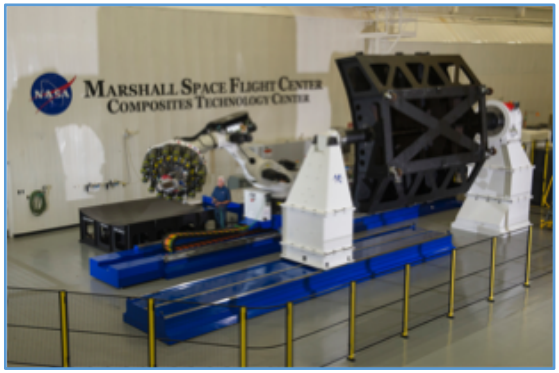
The MTC Advanced Manufacturing Centre
Coventry, UK

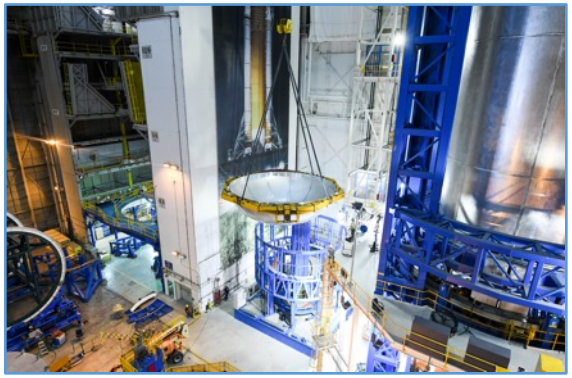
"The Future of Manufacturing"

Returning to the Moon in Five Years



NASA Manufacturing is…



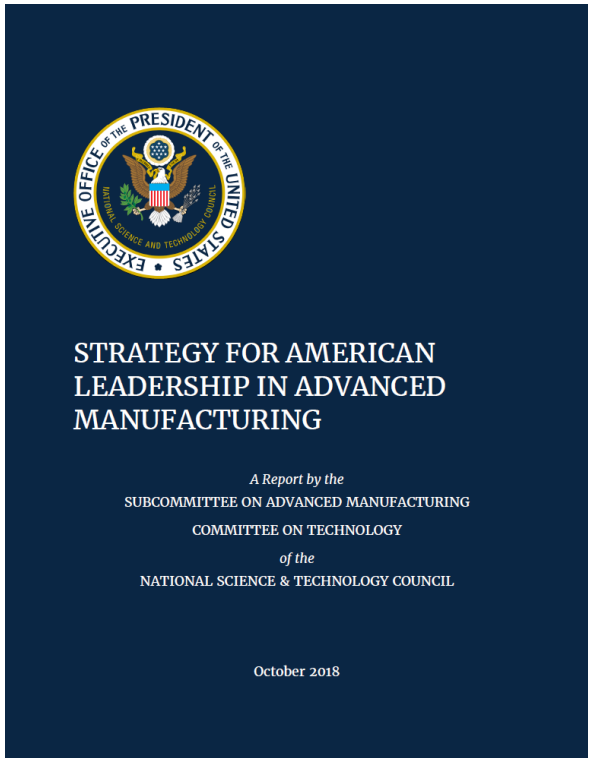


The Space Launch System

National Strategic Plan for Advanced Manufacturing

Goals

1. **Develop and transition new manufacturing technologies – 5 Objectives with 15 priorities**
2. **Educate, train, and connect the manufacturing workforce – 4 Objectives with 9 priorities**
3. **Expand the capabilities of the domestic manufacturing supply chain – 4 Objectives with 11 priorities**



https://www.whitehouse.gov/wp-content/uploads/2018/10/Advanced-Manufacturing-Strategic-Plan-2018.pdf

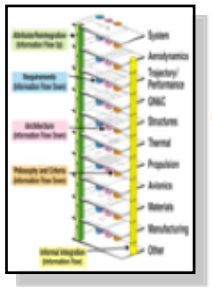
Digital Transformation

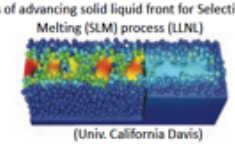
Desired Future State

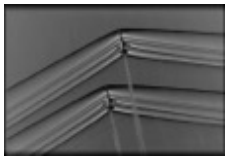
- Data Can Be Integrated and Automatically Couple the Virtual and Physical
- Digital Twin – Digital representation of a physical process/system/object
- Digital Thread – Communication framework that allows a connected data flow

Digital Transformation Major Trends

- ✓ Industry 4.0
- ✓ MGI/ICME
- ✓ Digital Twin / Digital Thread
- ✓ Big Data / Data Analytics
- ✓ AI / VR / AR
- ✓ Robotics / Autonomous Systems
- ✓ Model-based Engineering (MBx)
- ✓ 3D Printing
- ✓ Discipline Physics-based Models
- ✓ Integrating Science / Engineering
- ✓ Biomimetics
- ✓ Collaboration environments
- ✓ *And more…*







Digital Twin

Requirements → Materials → Design → Analysis → Manufacturing → Operations → Maintenance & Repair

Digital Integration Allows Predictive, Detective, and Corrective - Real Time Accurate Decisions

Additive Manufacturing at NASA

Launch Vehicles

- Design process culture shift
- Industrial base development
- Technology infusion for cost and schedule savings
- Large volume AM expands application
- Certification for flight

In-space

- On-orbit manufacturing
- Recycling for new feedstock
- Reduced necessity for spares
- Non-conventional electronics for space flight applications

Extraterrestrially

- Surface construction and manufacturing
- In-situ resource utilization

Significant Progress Made — Significant Challenges Remain

Sustainable Exploration
Links Discovery, Science and Commerce

The object of your mission is to explore the Missouri river…and its communication with the waters of the Pacific ocean…. for the ***purposes of commerce.***

Thomas Jefferson, 1803

The Next Generation

Systems Thinking, Entrepreneurship, Cultural Agility, Critical Thinking

Joseph E. Aoun, "Robot-Proof, Higher Education in the Age of Artificial Intelligence"

Thank You

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